What is claimed is

1. A process of lateral crystallization comprising:

providing a silicon film on a substrate surface;

heating a localized substrate region at the substrate surface to a temperature above the formal melting point of the substrate for a short period of time such that the substrate is not significantly damaged; and

irradiating a portion of the silicon film in thermal contact with the substrate region to crystallize the portion of the silicon film, while the localized substrate region remains above the formal melting point of the substrate.

2. A process of lateral crystallization comprising:

providing a silicon film on a substrate surface;

exposing a localized substrate region at the substrate surface to a laser heating source; and

annealing a portion of the silicon film in thermal contact with the localized substrate region by exposing the silicon film to a laser annealing source.

3. The process of claim 2, wherein the substrate surface is SiO_2, and the laser heating source has an optical wavelength of between approximately 9 and 11 μm.

4. The process of claim 3, wherein the laser heating source is a CO_2 laser.

5. The process of claim 4, wherein the CO_2 laser has a pulse duration of between approximately 0.01 milliseconds and 1 millisecond.

6. The process of claim 2, wherein the laser annealing source is an excimer laser.

7. The process of claim 6, wherein the excimer laser is a XeCl laser or a KrF laser.

8. The process of claim 6, wherein the excimer laser has a pulse duration of between approximately 30 nanoseconds and 300 nanoseconds.

9. The process of claim 2, wherein the laser annealing source is a solid-state laser.

10. The process of claim 9, wherein the solid-state laser is a frequency-doubled Nd-YAG laser or a frequency-doubled Nd-YVO_4 laser.

11. The process of claim 9, wherein the solid state-laser is a frequency-tripled Nd-YAG laser or a frequency-tripled Nd-YVO_4 laser.

12. The process of claim 2, wherein the laser annealing source has a discharge frequency of between approximately 100 Hz and 500 Hz.

13. The process of claim 2, wherein the laser annealing source has a discharge frequency of between approximately 10 kHz and 100 kHz.

14. The process of claim 2, wherein the laser heating source is pulsed, the laser annealing source is pulsed, and the laser heating source irradiates the substrate prior to irradiation of the silicon film by the laser annealing source pulse.

15. The process of claim 14, wherein the laser annealing source pulse is shorter than the laser heating source pulse, and starts during the laser heating source pulse.

16. The process of claim 15, wherein the laser annealing source pulse is completed during the laser heating source pulse.

17. The process of claim 14, wherein the laser annealing source pulse occurs after the laser heating source pulse.

18. A process of lateral crystallization comprising:

providing a silicon film in thermal contact with an SiO_2 layer on a substrate;

exposing a portion of the SiO_2 layer to a CO_2 laser pulse with a duration of between approximately 0.01 milliseconds and 1 millisecond, whereby the exposed portion of the SiO_2 layer is heated; and

crystallizing a portion of the silicon film in thermal contact with the heated portion of the SiO_2 layer by irradiating the portion of the silicon film with a pulsed, excimer laser; or a pulsed, frequency-doubled, solid-state laser.